tures. The results indicate that in the case of mean annual maximum temperatures continentality has a greater effect than latitude, whereas in the case of mean annual minimum temperatures, latitude is of equal importance with continentality.—*N. H. B.* 551.46(27)

*Some remarkable features of the Gulf Stream, by P. Idrac (Comptes Rendus des seances de l'Academie des Sciences, Tome 188, No. 9, p. 644).*—These studies were made this winter (1928–9) in the Florida Strait during the course of oceanographic researches assigned to me by Monsieur Claude in view of the installation on the coasts of Cuba of the first Claude-Boucherot works utilizing the thermal energy of the sea.

As is well known, the Gulf Stream is a warm current which, after being formed in the Gulf of Mexico, escapes toward the Atlantic Ocean through the passage about 70 miles wide and 1,000 to 1,800 meters deep separating Cuba from the reefs west of the point of Florida.

For four different dates in a period of three months I was able to construct thermal cross sections of the strait, each obtained from some 50 measurements to a depth of 1,000 meters well distributed over the whole extent of the strait, each of these measurements being checked by the simultaneous reading of two upsetting thermometers.

Some simultaneous measurements of the current were made from the surface to a depth of 1,400 meters by means of the recording apparatus for velocity and direction described in an earlier paper (Courants sousmarins de Gibraltar, Comptes Rendus, 186, 1928, p. 1058). The drift of the boat was reckoned from bearings of the land. The effect of the wind and the swell was eliminated by plunging the apparatus some meters below the surface, which gave the proper drift of the boat relative to the surface current. The apparatus was then lowered to different depths to obtain the velocity of the deep current relative to the drift of the boat, whence there could be deduced by a simple graph the actual velocity of the deep current.

Better than all explanations the figures give an idea of the structure of the Gulf Stream and of the rapid thermal variations which can in certain cases amount to more than 5° C. in five days.

Fortunately for the project of Monsieur Claude all of this variability fades out much below the depth of 800 meters, which appears scarcely touched by the Gulf Stream except when it is very strong. At 1,000 meters, for example, there is almost uniformly a temperature of 5° C. in the entire length of the channel.

The bulk of the current is generally nearer to the coast of Cuba than to the Florida Keys. It approaches or recedes, it seems, in a rather irregular manner, but in a manner that is without doubt connected with the extent of the cold current from Labrador, which extends, as is seen in the figures, along the coast of Florida, where it gives, at equal depth, lower temperatures than those on the Cuban coast.

At the surface the axis of the current of the Gulf Stream generally coincides roughly with the axis of the highest temperatures (yet when the Gulf Stream recedes from the Cuban coast the surface in that vicinity remains warm). Each time that we were able to make measurements we found that in the depths the axis of the current did not coincide with the vertical axis of the surface current and was plainly shifted toward the Cuban coast.

Where it is strongest (having a velocity of 3 knots in the period of our measurements) the current remains rather constant from the surface to a depth of 300 meters and then gradually weakens. Sometimes there are still found currents of 1 knot at the depth of 500 meters and of 0.5 knot at the depth of 1,000 meters.

From the results obtained there can be deduced the approximate discharge of the Gulf Stream. This, too, is very variable; for example, it was of the order of 50 cubic kilometers per hour on December 1, 1928, but amounted to about 90 cubic kilometers per hour on January 31, 1929.

Without doubt it would be interesting in the general study of the currents of the Atlantic Ocean and, perhaps, even of the climatic variations of western Europe to make periodic measurements of the discharge of this mighty river of warm water.

The first four figures (not reproduced) represent the thermal cross sections, on different dates, of the Strait of Florida between Havana and the Florida Keys. There will be noted, among other things, the rapidity of variation between November 26 and December 1, 1928.

The last figure shows the form of the current of the Gulf Stream off Havana. The heavier the shading, the stronger the current. The prolongation of the beds of the deep current toward Havana appears to be due to the influence of the cold current coming from Labrador and skirting the coast of Florida in the depths.—*Translated by W. W. Reed.*

*Early meteorological observations in northern Michigan.*—We are indebted to Nathan C. Rockwood, editor-manager of Rock Products of Chicago, Ill., for nine months meteorological observations made at Michilimackinac, Mich. (present Mackinac), by Captain Dunham from August, 1802, to April 1803, both inclusive. The observations came into Mr. Rockwood's possession through his great-grandfather William Dandridge Peck, professor of natural history at Harvard and an early American scientist. The observations were made three times daily at sunrise, noon, and sunset. The mean temperature has been computed by taking one-third of the sum of the means for the times mentioned, the resulting means being quite close to those that would be obtained from the daily extremes.

The temperatures recorded by Captain Dunham do not differ greatly from those made at Cheboygan, Mich., a short distance from Mackinac, in more recent times—the summary as prepared by the Climatological Division of the Weather Bureau follows.—*A. J. H.*

*Summary of meteorological observations at Michilimackinac (Mackinac), Mich., from August, 1802, to April, 1803, both inclusive*

| | Temperature | | | | | | | | | Days with precipitation | Days with snow | Days with thunderstorms | Days with fog | Clear | Partly cloudy | Cloudy | Wind—prevailing direction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean [1] | Maximum | Minimum | Mean Maximum | Mean Minimum | Range | | | | | | | | | | | |
| | | | | | | Mean daily | Greatest | Least | Absolute | | | | | | | | |
| **1803** | | | | | | | | | | | | | | | | | |
| January | 13.3 | 36 | −14 | 16.5 | 9.2 | 7.2 | 20 | 0 | 50 | 8 | 8 | 0 | 0 | 17 | 3 | 11 | W. |
| February [2] | 17.7 | 50 | −24 | 24.4 | 9.8 | 14.8 | 34 | 2 | 74 | 1 | 1 | 0 | 0 | 24 | 0 | 3 | S. |
| March | 25.2 | 49 | −10 | 30.3 | 19.4 | 10.9 | 24 | 0 | 59 | 8 | 3 | 0 | 4 | 17 | 2 | 12 | W. |
| April | 39.4 | 59 | 20 | 45.4 | 33.2 | 12.2 | 30 | 1 | 39 | 12 | 3 | 1 | 0 | 14 | 5 | 11 | E. |
| **1802** | | | | | | | | | | | | | | | | | |
| August | 67.4 | 83 | 36 | 71.9 | 62.1 | 9.7 | 32 | 2 | 47 | 7 | 0 | 3 | 4 | 23 | 1 | 7 | SW. |
| September [3] | 61.8 | 73 | 40 | 65.9 | 57.5 | 8.9 | 26 | 2 | 33 | 6 | 0 | 1 | 1 | 19 | 4 | 6 | N. |
| October | 51.0 | 72 | 30 | 55.4 | 46.5 | 8.6 | 18 | 2 | 42 | 9 | 2 | 0 | 2 | 11 | 2 | 18 | N. |
| November | 41.9 | 60 | 29 | 44.2 | 39.4 | 4.9 | 15 | 1 | 31 | 7 | 3 | 0 | 4 | 10 | 1 | 19 | S. |
| December [4] | 21.0 | 49 | −11 | 24.0 | 17.5 | 6.6 | 15 | 0 | 60 | 7 | 7 | 0 | 1 | 16 | 2 | 12 | N. |

[1] Mean of 3 observations, sunrise, noon, and sunset. [2] Record for 27 days. [3] Record for 29 days. [4] Record for 30 days.

*Measurement and determination of magnitude of cooling. (By Dr. V. Conrad, Vienna, reprinted from Gerlands Beiträge zur Geophysik Vol. XXI, Part 2/3, 1929.)*—Summary: From January to April, 1928, observations with L. Hill's katathermometer were being made at the sanatorium Grafenhof (Salzburg). Synchronous measures of air temperature and wind velocity (with the anemometer) allowed a comparison between the cooling power observed with the Kata ($H$) and calculated out of the wind velocity and air temperature with Doctor Hill's formula ($h$). The investigation shows: (1°) That the quotient $H/h$ is very little influenced by the air temperature; (2°) that there is a functional connection between the value of $H/h$ and the wind velocity. Within certain bounds, given by the present observations it is possible to express the mentioned connection analytically. The size of $H/h$ reaches values $>2$ at very little velocities and becomes nearly constant (0.9) at velocities $>1$ m/s. If the conclusions drawn from the present material hold, it will be possible to calculate the cooling power in mgcal/cm$^2$, sec. out of wind velocity and air temperature (for velocities $>1$ m/s) with Hill's formula slightly corrected.

*Tornado, May 1, 1929, at Fort Smith, Ark.* (By Truman G. Shipman).—The morning weather map of May 1, 1929, showed a troughlike barometric depression extending from the Rio Grande Valley northeast across the middle Lakes region. A pressure reading of 29.48 inches was reported at Abilene, Tex. An extensive HIGH covered the western portions of the United States with a pressure reading of 30.36 inches at Boise, Idaho. Sharp drops in temperature and steep temperature gradients were noted over western Texas and the southern Rockies. A rather well defined line of opposing winds appeared near the center of the trough. The P. M. map showed much the same conditions moved eastward with a low pressure reading of 29.38 inches over Little Rock, Ark. The morning map of May 2, 1929, published at Washington, D. C., showed that the southern center of the depression moved about 1,250 miles in 24 hours or about 52 miles an hour.[1] This is considerably less than the velocity of the tornado as it passed over Fort Smith.

Telephone calls and weather conditions indicated the presence of a tornado at 2:30 p. m. The beginning of the tornado could not be seen from the office as it approached from the opposite side of the building. An attempt was made, but given up to reach the roof at this time. After the storm had passed northeast of the building, two office employees ascended to the roof and saw the tornado cloud over Sand Prairie, Crawford County.

The tornado formed in Oklahoma and was observed by a bus driver along the Fort Smith-Gore Highway. It was also observed at Peno, Okla., about 4 miles west of Fort Smith. It almost followed the path of the tornado that struck Fort Smith, May 28, 1924, and seemed to be high in the air as that storm was. The first funnel cloud observed in Fort Smith appeared where Wheeler Avenue crosses the Missouri Pacific tracks where it hit the Fort Smith Handle Co.'s plant. This cloud was described as a ropelike or serpentlike formation swaying in the air, but rather clear and distinct. The heaviest damage was inflicted here and along a path about one-fourth to one-half mile to the east. The second tornado cloud was shaped like a sheaf and was wide and less distinct. The third cloud was an inverted cone which did not reach the ground but formed immediately after the second. The storm then seemed to pass almost entirely over the city doing only light, scattered damage until its reached Sand Prairie, Crawford County, about 8 miles distant. This tornado cloud was observed by the employees of the office from the roof of the Federal Building in Fort Smith at 2:37 p. m. The cloud was shaped like an inverted truncated cone, rather wide and poorly defined and its outlines somewhat dimmed by light rains. The tornado had traveled 8 miles in 7 minutes at about 69 miles an hour which is close to the extreme wind velocity as recorded at the Weather Bureau office. In general the path was slightly north of east and very narrow. The nearest part of the path lay about 1¼ miles southeast of the office building.

Before the arrival of the first funnel-shaped cloud in Fort Smith at Wheeler Avenue and to the right and in the rear of where the cloud formed, an educated and reliable observer reported rain descending in sheets, clouds seemed to be boiling over and between the sheets of descending rain, an open space. He interpreted this as a wide, sheaf-shaped vortex without the cloud sheet leaving it transparent.

At a few times in the path of this tornado, what appeared to be explosive effects accompanied by vapor were seen and reported by observers, including Mr. Baughman of the Weather Bureau office. These observations are quite interesting and would indicate that the temperature in the tornado funnel varied during its progress, ranging from slightly below to slightly above the dew point. The thermograph at the Weather Bureau office, 1¼ miles distant, showed a temperature of 66° (fig. 1) at the time of the tornado and a dew point of 63° was observed at a special observation at 2:50 p. m.

[1] It is preferred to believe that there was a rise in pressure in the southern end of the trough which would automatically transfer the center to the north, rather than that there was an actual progression of the southern center.—ED.